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VINYL CHLORIDE AS AN AIRBORNE HAZARDOUS CONTAMINANT I

Progress Report No. I

MARCH 1975

Report No. ARB-TDA-02-75

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1975

Ontario

Ministry of the Environment

The Honourable
William G. Newman,
Minister

Everett Biggs,
Deputy Minister

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AIR RESOURCES BRANCH

Special Studies & Program Planning Unit
Technology Development & Appraisal Section

Report No.
ARB-TDA-02-75

SURVEY OF VINYL CHLORIDE MONOMER CONCENTRATIONS IN AMBIENT AIR NEAR THE ESSO CHEMICAL POLYVINYL CHLORIDE AND DOW CHEMICAL VCM PLANTS IN SARNIA, ONTARIO DURING SEPTEMBER, OCTOBER AND NOVEMBER, 1974

Progress Report No. 1

Ministry of the Environment
Air Resources Branch
880 Bay Street, 4th Floor
Toronto, Ontario.

March 1975

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1. CONCLUSIONS

The results of the first comprehensive field sampling measurements carried out by the Air Resources Branch, Technology Development and Appraisal Section, to monitor the concentrations of vinyl chloride monomer (VCM) in ambient air near an industrial source of VCM suggest that, at times, community exposure exceeds the current air quality guidelines established by the Ministry. Seven percent of the valid samples of ambient air collected in the vicinity of the Esso Chemical Plant at Sarnia, Ontario, were analyzed to contain greater than 0.2 ppm (560 ug/m^3) VCM, which is the current guideline for 1/2 hour average samples. (Appendix I)

The monitoring and analytical techniques which have been developed by the Air Resources Branch and the Air Quality Laboratory, and which are detailed in Sections 5 and 6 of this report, have proved to be capable of detecting VCM in ambient air with the sensitivity and accuracy required for a routine monitoring survey.

With reference to the specific source which was monitored, Esso Chemical Canada, it is premature to conclude that this plant is allowing excessive quantities of VCM to be vented to the atmosphere continually or regularly. The results of the sampling measurements described in this Report imply, however, that, at times, and for distances up to 1/2 mile downwind from the plant, the level of emissions can exceed the Ministry's guideline. The Dow Chemical Company of Canada Limited plant, which manufactures VCM, is near the Esso Chemical Canada plant, but there does not appear to be a correlation between VCM levels and proximity to the Dow plant, which implies little or no interference from this possible second source. A more thorough and extensive monitoring

programme in the vicinity of the Esso plant is indicated.

The Ministry of the Environment's (MOE) guideline for maximum allowable VCM concentrations over a 1/2 hour period was exceeded at one or more sampling sites on 4 of the 10 sampling days. (See Results.)

Detectable concentrations of VCM were measured up to 2 miles downwind from the Esso plant. On one occasion, a concentration of 0.05 ppm was detected in the central business district of Sarnia (Front St. & London Road).

Because of the generally inclement weather conditions, which included rain on most days, there was some interference with sample collection. The results of this survey should thus be considered preliminary to a more carefully planned and more thorough long-term program to assess whether the Esso Chemical Canada PVC plant is in compliance with the current Ministry guidelines. The general agreement between the charcoal tube analyses and the Tedlar bag grab sample analyses done on-site by Environment Canada (see Appendix II) supports the validity of the Air Resources Branch measurements.

2. RECOMMENDATIONS

1. Five long-term monitoring stations should be established immediately in Sarnia at the following locations:

(1) North side of Fiberglas Canada Ltd. buildings on Kenny Street (about 800 feet south of the Esso Chemical plant).

(2) Near the intersection of Clifford and Vidal Streets (about 1,600 feet north of the plant).

(3) Near the intersection of St. Andrew and Vidal Streets (about 3,100 feet NNE of the plant).

(4) In the vicinity of Beaver Lumber Co. on Union Street near Vidal (about 3,500 feet NE of the plant).

(5) Near the Victoria Street Station (about 8,800 feet NNE of the plant).

These stations would be situated to monitor VCM concentrations at the point of the highest measured levels in the present and preliminary surveys (1); at the nearest residential areas (2,3); on a path from the Esso plant to the central part of the city and major residential areas (4); and in the central area of the city (5). These stations should monitor twice a week for 6 to 9 months.

2. Because of the apparent intermittent nature of VCM emissions from PVC plants, monitoring programmes should be designed for continuous surveillance over 24-hour periods of time, related to the production schedule of the plant being surveyed, where possible. One objective of continuous monitoring is, of course, to determine whether the 24-hour average concentration of VCM exceeds the current guideline.

3. The activated charcoal-filled adsorption tube collector system may be supplemented by the use of "Multi-Layer" opaque plastic gas sampling bags where this is desirable. The Air Quality Laboratory has

demonstrated that samples collected in these bags give results consistent with the charcoal tube method. Some difficulty has arisen in the testing and use of Tedlar sampling bags, which are recommended by the U.S. Environmental Protection Agency (EPA) for sampling VCM.

4. The Air Quality Laboratory should continue stability tests on the long-term keeping properties of VCM samples. See Sections 6. and 10.

5. The sampling train for use by the Regional Offices should be designed in consultation with the Technology Development and Appraisal Section (see Section 5.).

3. INTRODUCTION

There is evidence to suggest that exposure to vinyl chloride monomer in unspecified concentrations may be related to the development of certain diseases of the liver and other organs in man. A summary of the present state of knowledge of the effects and control of VCM appears in the Ministry report "Vinyl Chloride as an Airborne Hazardous Contaminant I" (ARB-TDA-01-74).

Although the medical basis for establishing air quality criteria and standards for ambient air is still uncertain, the Ministry has developed guidelines for the assessment of community exposure to VCM (see Appendix I).

The current temporary Ministry guidelines for the maximum allowable concentrations of VCM in ambient air averaged over 24 hours is 280 ug/m^3 (approximately 0.10 ppm) and is 560 ug/m^3 (approximately 0.20 ppm) for 1/2 hour average samples at a point of impingement relative to an individual source.

This survey of the air in the vicinity of the Esso Chemical Canada plant in Sarnia was conducted to assess whether the guidelines were being met at this site. Preliminary measurements on the site (Sept., 1974, Results, Tables III and IV) suggested that there might be appreciable concentrations of VCM in the ambient air.

As noted in ARB-TDA-01-74, page 12, the greatest hazard from VCM emissions is thought to occur not in the VCM manufacturing plants themselves (such as Dow Chemical Co. of Canada Ltd., Sarnia), but in the polyvinyl chloride (PVC) resin manufacturing plant(such as Esso Chemical Canada, Sarnia). Preliminary measurements of the ambient air from 200 to 1,200 feet

from the Dow plant confirmed this point of view (see Results, Table III).

The VCM escapes to the atmosphere during transfer operations at the PVC plant and may be vented to the atmosphere at various points in the polymerization process (see ARB-TDA-01-74, page 16).

The survey which is the subject of this report was carried out during the periods September 9, 1974 to September 13, 1974 and October 29, 1974 to November 8, 1974 inclusive, a number of sites being sampled each day. No attempt was made to correlate the sampling times with the production schedules of the plants.

4. SOURCE DESCRIPTION

The sources which were monitored in this survey were the PVC production plant of Esso Chemical Canada, Division of Imperial Oil Enterprises Limited, Christina and Clifford Streets, Sarnia, Ontario, and the VCM production plant of Dow Chemical of Canada Limited, Vidal Street South, Sarnia, Ontario. Initial sampling of the ambient air on the sites and in the vicinity of both the Esso Chemical plant and the nearby VCM production plant of Dow Chemical (see Table II) demonstrated that the PVC plant (Esso) was potentially a more significant source of VCM, because of the detectably higher levels at greater distances from the plant.

The emission of VCM to the atmosphere occurs at various points in the PVC polymerization process, notably from the slurry tank exhaust vents and the drying oven stack, in addition to various transfer and packing locations internal and external to the plant. Since the plume of VCM from either vent or stack is invisible, it is difficult to determine a point of impingement for sampling, which proved to be a major problem. The drier stack at Esso is approximately 135 feet tall.

PVC is produced in a semi-batch process, rather than a continuous-feed process, so that VCM emissions are expected to be intermittent.

Esso officials estimate that approximately 1,000 lbs. of VCM are lost per day of PVC production. Presumably, most of this quantity is vented to the atmosphere.

5. MONITORING TECHNIQUE (ARB-TDA-01-74, page 32 and Appendix II, Section 7.1)

Activated charcoal-filled glass tubes per ARB-TDA-01-74, Appendix II, Section 7.1 were used to trap VCM from ambient air by adsorption. The sampling train is shown in Figure 1.

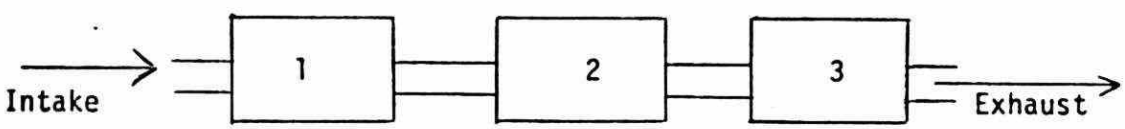

FIGURE 1.

1. Gilmont calibrated flow meter
2. Activated charcoal-filled glass tube, two stages
3. Bendix Micronair II or Casella battery-powered pump

With the pump running, the flow was adjusted to approximately 500 standard ml/minute and a starting time recorded. The flow meter was then removed. After a period of from 1 to 6 hours, the flow meter was replaced and the flow rate and time again recorded, and the pump turned off. The product of the flow rate, averaged linearly over the sampling time if necessary, with the elapsed time gave the total volume of air sampled at a pressure of 1 atmosphere.

The distance from the sampling site to the Esso plant, the compass direction to the plant and the location of the sampling site (as identified with reference to the city street grid) were also recorded. General weather conditions were noted and later augmented (see Section 7.) with detailed meteorological data for the appropriate days.

Sampling sites were chosen so that the sampler would be downwind, or roughly downwind, from the source (see Sections 7. and 9.). The downwind direction was determined by visually sighting local wind and plume direction and by consulting the Sarnia Airport for prevailing wind direction. During a given period of time, several samplers were set up at different distances from the source, in a short arc where this was possible. This latter precaution insured that a representative sample would be obtained even with some shift in wind direction.

For the long-term monitoring stations which are recommended in Section 2., the sampling train would be modified to include a standard main-powered pump in place of the small battery-powered pump which was used in this study, and the flowmeter would be fixed in place downstream from the carbon tube.

During the same period of time as the carbon adsorption tube sampling was carried out, a series of Tedlar bag grab samples were also taken. Only a few grab samples were obtained in the September preliminary survey and these were returned to Toronto for analysis. During the October/November survey, a large number of Tedlar bag samples were analyzed on-site by a gas chromatography system supplied by Environment Canada and operated by their personnel.

6. ANALYTICAL TECHNIQUE (ARB-TDA-01-74, page 34 and Appendix II, Sections 7.2 and 7.3)

142 charcoal sampling tubes were analyzed by the Air Quality Laboratory according to the prescribed method. The analysis was done by gas chromatography using either Porapak Q or Chromosorb 102 columns at 149°C and flame ionization detection. The results are tabulated in Section 9.

The VCM was desorbed from the activated charcoal in 20 ml. of carbon disulphide in an ice-water bath and a sample injected by syringe into a GC. Preliminary adsorption-desorption tests performed by the Air Quality Laboratory indicate that at least 70% efficiency,and more typically approaching 90% efficiency, is achieved by the prescribed method.

The reproducibility of analyses for duplicate samples of the same known initial concentration is typically $\pm$ 10%, but can be as high as $\pm$ 20%. Since most of the inefficient steps in the procedure tend to lose VCM, the reported results tend to underestimate the amount of VCM in the original sample. The only step which may concentrate the sample, thus overestimating the concentration of VCM, is evaporation of carbon disulphide solvent from the tip of the GC syringe during transfer of the solution from cooling bath to GC septum.

Stability tests indicate that the VCM concentration of samples in charcoal tubes or in Tedlar or polypropylene "Multi-Layer" bags does not change appreciably for several weeks when stored at 2°C. These tests are continuing to determine the longer-term stability of cooled VCM samples.

Although two-stage collection tubes were used, analysis showed that no detectable VCM appeared in the second stage. That is, the

first stage of charcoal is sufficient to trap the small amounts of VCM encountered in this survey.

The Tedlar bag grab samples were analyzed in the prescribed manner with the Environment Canada GC in Sarnia shortly after collection.

7. METEOROLOGICAL CONDITIONS

The accompanying wind speed and wind direction record (Appendix II) at the Ministry's Courtright Station (complemented by data from the Sarnia airport, where necessary) gives data for the period October 29th to November 7th, 1974. The weather was generally very damp with frequent periods of light rain. Winds were light, varying from 1 to 14 miles/hour, during the sampling periods over the duration of the survey. The rain, together with local variations in wind direction, at the sampling sites spoiled some samples. The effect of rain on the amount of VCM collected at a given site is not known. VCM is slightly soluble in water, but this concentrating effect was opposed by the tendency of rain water to slow down or stop the flow of air through some of the charcoal tubes.

8. MAP

The accompanying map of Sarnia, Figure 2., shows the location of each sampling site in this survey, as well as the recommended locations of the five long-term sampling stations.

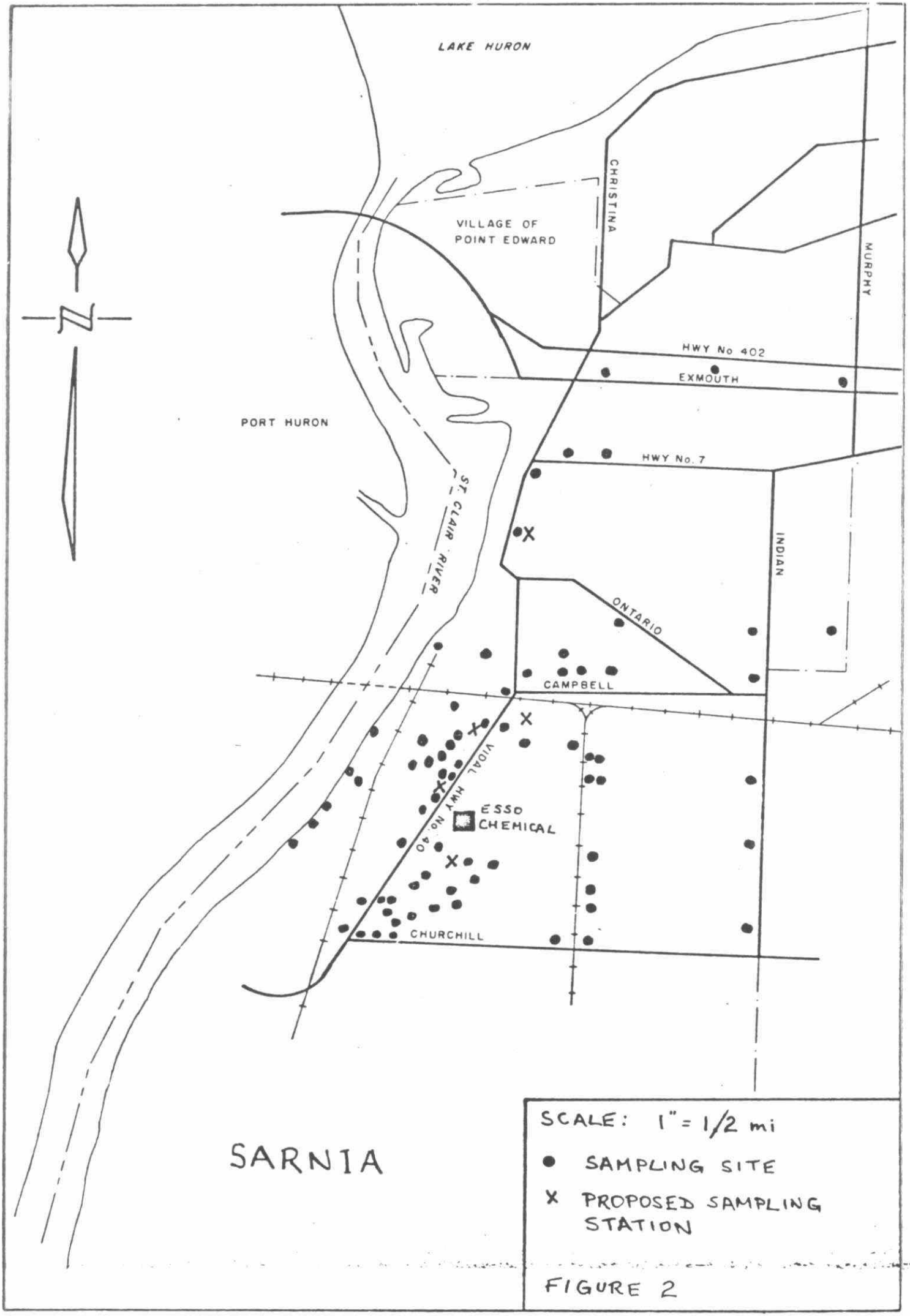
LAKE HURON
CHRISTINA
MURPHY
VILLAGE OF
POINT EDWARD
HWY No 402
EXMOUTH
PORT HURON
HWY No. 7
ST. CLAIR RIVER
INDIAN
ONTARIO
CAMPBELL
VIDAL HWY No 40
ESSO
CHEMICAL
CHURCHILL
N
SARNIA
SCALE: 1" = 1/2 mi
SAMPLING SITE
PROPOSED SAMPLING STATION

FIGURE 2

9. RESULTS

Table 1 lists the results of the analyses of the samples taken during the period October 28th, 1974 - November 8th, 1974 and analyzed in the Air Quality Laboratory. Figure 3 is a plot of the logarithm of the concentrations of VCM versus distance from the Esso PVC facility for October 30th, 1974 and November 5th, 1974. These are the only days for which sufficient data are available to indicate a definite relationship. This graph shows that the fall-off in concentration is approximately logarithmic as expected on the basis of the usual dispersion theory for a single source. Only those samples in which VCM was actually detected and which were collected within about 30^{o} of the average downwind direction are represented in Figure 3.

Table II contains the results of on-site GC analyses of Tedlar bag samples collected during the same time period as the charcoal tube samples. These analyses were performed by Environment Canada personnel on their mobile GC equipment. Unfortunately, the sampling site and date identifications for most of these samples are not available. The highest levels found in these samples, however, correlate with the highest levels found in the charcoal tube samples; that is, the highest concentrations (up to 1.5 ppm) occurred near the Fiberglas Canada Ltd. plant on several different days.

It should be noted that nearly 60% of the samples analyzed for no detectable amount of VCM (< 0.01 ppm). Even at downwind sites which had very high VCM concentrations on a given day had no detectable VCM on another day. This merely emphasizes the great variability of VCM levels at a given site from day to day.

Tables III and IV list the results of the preliminary survey at the Dow (Table III) and Esso (Table IV) plants during September, 1974.

The results in Table III (Dow) were all obtained from samples which had all been collected downwind under conditions of light, steady wind. Those in Table IV (Esso, preliminary) were obtained under conditions of frequently shifting wind speed and direction, such that most of the corresponding samples were not always downwind. These facts should be borne in mind when interpreting these preliminary results from the September survey.

TABLE I

VINYLCHLORIDE LEVELS AT ESSO, SARNIA

DATE	Sample Number	Average WS(mph), WD	Location	Vinylchloric ppm
Oct.29	SP-1	9, SW	1600' N	<.01
	SP-2	9, SW	800' NNW	0.38
	SP-3-1		1000' N	0.08
	SP-3-2	9, SW	1000' N	<.01
	SP-4	7, SSW	1800' N	<.01
	SP-5-1		2800' NNW	<.01
	SP-5-2	8, SSW	2800' NNW	<.01
	SP-6	9, SSW	-	-
Oct.30	SP-24	11, WSW	1600' NNE	0.18
	SP-7	12, WSW	1800' N	0.02
	SP-8	12, WSW	2400' NNW	<.01
	SP-9	11, WSW	2000' NNE	0.09
	SP-10	11, WSW	2400' NNE	0.03
	SP-11	12, WSW	3000' NNE	0.02
	SP-12	12, WSW	2800' NNE	0.02
	SP-13	12, WSW	2400' S	0.01
	SP-14	13, WSW	1600' NNE	0.06
	SP-15	13, SW	2800' NNE	0.20
	SP-16	13, SW	2400' NNE	<.01
	SP-17	13, SW	1800' N	0.11
Oct.31	SP-18	11, WSW	1800' N	0.12
	SP-19	11, WSW	1600' NNE	0.01
	SP-20	10, WSW	3000' NNE	<.01
	SP-21	10, WSW	3200' NNE	<.01
	SP-22	13, WSW	3800' NNE	<.01
	SP-23	11, WSW	3600' NE	<.01
	SP-25	14, SW	-	-
	SP-26	12, SW	1600' NNE	0.02
	SP-27	12, SW	3000' NNE	<.01
	SP-28	12, SW	3600' NE	<.01
	SP-29	11, SW	3200' NNE	<.01
	SP-30	-	-	-
	SP-31	-	-	-
	SP-32	9, SW	3400' NNE	<.01
	SP-33	9, SW	2200' NNW	0.03
Nov.1	SP-34	12, W	3800' NNE	0.02
	SP-35	12, WNW	3600' NE	<.01
	SP-36	12, WNW	1600' NNE	0.02
	SP-37	13, WNW	4400' ENE	<.01
	SP-38	13, WNW	4800' ENE	0.02
	SP-39	13, NW	3600' ENE	0.01
	SP-40	13, NW	4000' ENE	<.01
	SP-41	13, NNW	4800' NE	<.01
	SP-42	12, NW	4000' ESE	0.01
	SP-43	11, NW	4000' ENE	0.05
Nov.2	SP-44-1	6, ESE	1800' N	<.01
	SP-44-2	6, ESE	1800' N	<.01
	SP-45	6, ESE	2300' NNW	<.01
	SP-46	6, ESE	600' WNW	0.12

...2

TABLE I (cont'd)

VINYLCHLORIDE LEVELS AT ESSO, SARNIA

DATE	Sample Number	Average WS (mph), WD	Location	Vinylchloric ppm
Nov.2	SP-47	5, SE	3400' WNW	<.01
	SP-48	6, S	3200' NW	<.01
	SP-49	6, SSE	3000' WNW	<.01
	SP-50	5, SE	3200' WNW	<.01
	SP-51	5, SE	3200' WNW	<.01
	SP-52	5, SE	3800' W	<.01
	SP-53	6, S	3200' WNW	<.01
	SP-54	5, SW	2800' NW	<.01
	SP-55	6, WSW	3200' WNW	<.01
	SP-56	6, WSW	3000' WNW	<.01
	SP-57	4, S	3200' NW	<.01
Nov.3	SP-58	9, SSE	1800' N	0.06
	SP-59	9, SSE	3200' NNE	<.01
	SP-60	10, S	-	-
	SP-61	-	-	-
	SP-62	10, S	3000' NNE	0.01
	SP-63	10, S	5600' N	<.01
	SP-64	10, S	6000' NNE	0.01
	SP-65	10, S	6800' NE	<.01
	SP-66	10, S	5500' NE	<.01
	SP-67	10, S	5600' NW	0.01
	SP-81	10, S	5000' NNE	0.01
	SP-68-1		1100' NNE	0.05
	SP-68-2	10, S	1100' NNE	<.01
	SP-69	10, S	1100' NNE	<.01
	SP-70	-	1100' NNE	-
Nov.4	SP-71	8, NW	2000' SSW	0.01
	SP-72	8, NW	5800' S	<.01
	SP-73	8, NW	5800' S	<.01
	SP-74	8, NW	2600' S	0.03
	SP-75	8, NW	2600' SSE	<.01
	SP-76	8, NW	4000' SSW	0.03
	SP-77	8, NW	5000' SW	0.01
	SP-78	8, NW	4200' SW	0.02
	SP-79	8, NW	1200' SW	0.03
	SP-80-1		2600' SW	<.01
	SP-80-2	9, NW	2600' SW	<.01
	SP-82	9, NW	3200' SW	<.01
	SP-83	7, NNE	1400' WSW	0.05
	SP-84	7, NNE	2200' SW	<.01
	SP-85	7, NE	1000' WSW	0.25
Nov.5	SP-86	12, NE	800' W	<.01
	SP-87	-	-	<.01
	SP-88	12, NE	1400' WSW	0.09
	SP-89	12, NE	3200' SW	0.04
	SP-90	12, NE	1600' SW	0.48
	SP-91	12, NE	800' SW	0.95
	SP-92	12, NE	1600' SSW	0.58
	SP-93	10, NE	1600' S	0.23

TABLE I (cont'd)

VINYLCHLORIDE LEVELS AT ESSO, SARNIA

DATE	Sample Number	Average WS(mph), WD	Location	Vinylchlorid ppm
Nov.5	SP-94	10, NE	2900' SW	0.03
	SP-95	-	-	<.01
	SP-96	10, NE	4000' SSW	0.05
	SP-97	9, NE	4200' SW	0.03
	SP-98	9, NE	5000' SW	<.01
	SP-99	-	-	-
	SP-100	10, NNE	800' S	0.20
	SP-101	10, NNE	1600' SSE	0.35
	SP-102	11, NNE	2800' SSW	0.03
	SP-103	9, NNE	2800' S	0.02
	SP-104	9, NNE	2800' SSW	<.01
	SP-105	8, NNE	2800' SSW	0.12
	SP-106	8, NNE	4000' SSW	0.04
	SP-107	8, NNE	3600' SSW	<.01
Nov.6	SP-108	10, NNE	4000' ESE	<.01
	SP-109	-	-	<.01
	SP-110	10, NNE	1600' SE	0.07
	SP-111-1		1200' SE	0.10
	SP-111-2	10, NNE	1200' SE	<.01
	SP-112	10, NNE	4800' ESE	<.01
	SP-113	10, WNW	5600' SE	<.01
	SP-114	10, NNE	4400' SSE	<.01
	SP-115	10, N	1600' SSE	<.01
	SP-116	10, N	7200' SE	<.01
	SP-117	10, N	2600' SSE	<.01
	SP-118	9, NNE	5000' SE	<.01
	SP-119	10, WNW	7200' SE	<.01
	SP-120	10, WNW	4400' SSE	<.01
	SP-121	10, WNW	1600' SSE	<.01
	SP-122	10, WNW	1200' SE	<.01
	SP-123	10, WNW	1600' SE	<.01
	SP-124	-	-	<.01
	SP-125	10, WNW	8400' SE	<.01
	SP-126	10, WNW	2600' SSE	<.01
Nov.7	SP-127	2, WSW	12200' E	<.01
	SP-128	2, WSW	1100' ENE	<.01
	SP-129	2, WSW	11200' NE	<.01
	SP-130	2, WSW	12200' ENE	<.01
	SP-131	2, WSW	3000' NNE	<.01
	SP-132	7, W	5400' NNE	<.01
	SP-133	7, W	6200' NE	<.01
	SP-134	7, W	8000' NE	<.01
Nov.8	SP-135	2, WSW	8500' E	<.01
	SP-136	2, NW	4000' ENE	<.01
	SP-137	2, WSW	9000' E	<.01
	SP-138	4, WNW	13600' SSW	<.01
	SP-139	4, WNW	14400' SSW	<.01
	SP-140	4, WNW	16800' SW	<.01
	SP-141	-	-	<.01
	SP-142	-	-	<.01

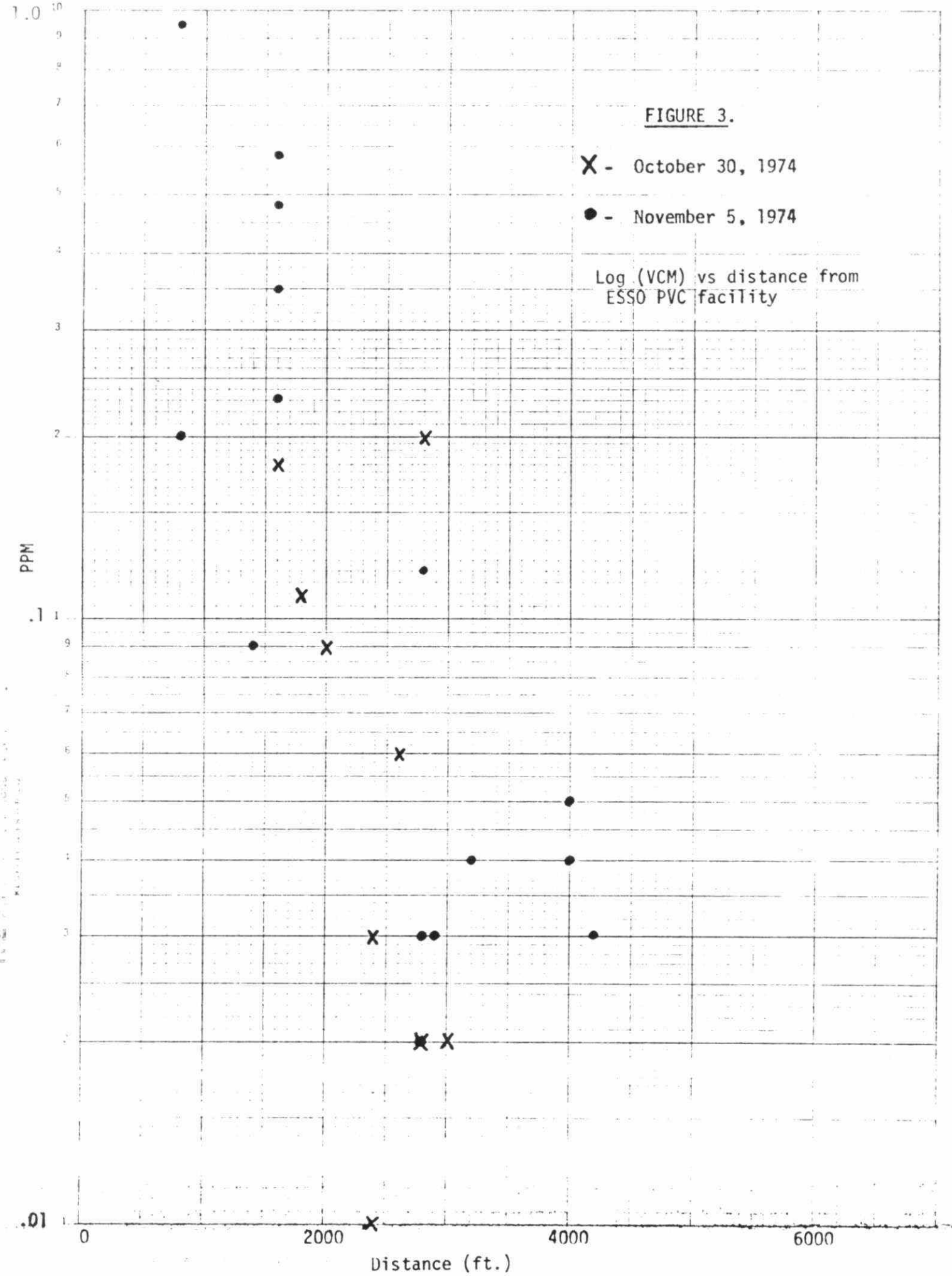
1.0
.1
.01
PPM
0
2000
4000
6000
Distance (ft.)
X - October 30, 1974
● - November 5, 1974
Log (VCM) vs distance from
ESSO PVC facility

FIGURE 3.

RESULTS TABLE II - Vinyl Chloride Levels at Esso, Sarnia
(On-Site Grab Bag Sample Analyses)

"S" SERIES

	PPM	$\mu g/m^3$	
S1	ND	-	
S2	ND	-	
S3	Trace	-	
S4	ND	-	
S5	0.02	51.2	
S6	Trace	-	
S7	0.03	76.8	
S8	-	-	
S9	ND	-	
S10	Trace	-	
S11	ND	-	
S14	Trace	-	
S15	0.41	1049.6	Near the Fiberglas Plant
S16	0.70	1792.0	
S17	0.66	1689.6	
S18	0.52	1331.2	
S19	1.54	3942.4	
S20	0.06	153.6	
S21	0.42	1075.2	
S22	ND	-	
S23	0.22	563.2	
S24	ND	-	

TABLE II (Cont'd)

"J" SERIES

		PPM	$\mu g/m^3$	Location
Oct. 30	J1	ND	-	1600' NNE
"	J3	ND	-	3200' NNE
Nov. 1	J5	ND	-	9100' ENE
Nov. 2	J6	ND	-	2900' SW
"	J7	0.04	102.4	3300' S
"	J10	0.01	25.6	1400' WSW
"	J11	ND	-	3200' WNW
Nov. 3	J12	0.2	512	1400' NNE
"	J13	ND	-	3000' NNE
"	J14	ND	-	10800' N
Nov. 4	J15	0.13	332.8	1000' WSW
"	J16	Trace	-	--

TABLE II (Cont'd)

"G" SERIES

	PPM	µg/m³	
G1	ND	-	
G2	ND	-	
G4	ND	-	
G5	0.21	537.6	
G6	ND	-	
G7	0.64	1638.4	Near the Fiberglas Plant
G8	0.21	537.6	
G9	0.53	1356.8	
G10	0.20	512.0	
G12	0.15	384.0	
G13	0.06	153.6	
G14	0.32	819.2	
G15	0.13	332.8	
G16	0.04	102.4	
G17	ND	-	
G18	0.22	563.2	
G19	ND	-	
G20	Trace	-	
G21	ND	-	
G22	0.01	25.6	
G23	ND	-	
G24	0.03	76.8	
G25	ND	-	
G26	ND	-	
G27	0.02	51.2	

TABLE II (Cont'd)

"T" SERIES

		PPM	$\mu g/m^3$	Location
Oct. 29	T2	ND		3200' WNW
Oct. 30	T4	0.25	640	1000' N
	T6	ND	-	
	T7	Trace	-	
	T8	Trace	-	
	T9	0.05	128	
	T10	Trace	-	
	T11	ND	-	
	T12	Trace	-	
	T13	ND	-	
	T14	Trace	-	
	T15	ND	-	
	T16	Trace	-	
	T17	0.11	281.6	
	T18	0.82	2099.2	
	T19	0.26	665.6	

TABLE II (Cont'd)

"B" SERIES

	PPM	$\mu g/m^3$
B1	ND	-
B2	ND	-
B3	ND	-
B4	ND	-
B5	ND	-
B6	0.02	512.0
B7	0.07	179.2
B8	0.03	76.8
B9	Trace	-
B10	0.05	128.0
B11	ND	-

"SS" SERIES

SS1	ND	-

SUMMARY OF AIR SAMPLES TAKEN NEAR DOW

TABLE III

PLE #	DATE	SITE	DISTANCE	TIME ON	TIME OFF	FLOW	CONCEN.
20	Sept. 9	1	200 ft. N.	3:40 pm.	9:40 pm.	.18	.255 ppm
21	Sept. 9	2	900 ft. N.	4:00 pm.	9:45 pm.	.17	.059 ppm
19	Sept. 9	3	1,175 ft. N.	4:05 pm.	9:55 pm.	.175	.025 ppm
16	Sept. 10	1	200 ft. N.	9:30 am.	5:50 pm.	.25	.135 ppm
17	Sept. 10	3	1,175 ft. N.	9:40 am.	5:30 pm.	.23	.024 ppm
18	Sept. 10	4	1,200 ft. NW	9:40 am.	6:00 pm.	.25	.013 ppm
9	Sept. 11	1 *	200 ft. N.	11:00 am.	4:00 pm.	.154	.035 ppm
10	Sept. 11	2 *	900 ft. N.	10:45 am.	4:00 pm.	.158	.026 ppm
11	Sept. 11	6 *	400 ft. N.	10:52 am.	4:05 pm.	.157	.025 ppm

* Dow also took sample at same location.

SUMMARY OF AIR SAMPLES TAKEN NEAR IMPERIAL OIL

TABLE IV

SAMPLE	DATE	SITE	DISTANCE	TIME ON	TIME OFF	FLOW	VC'1 CONCENTRATIO
14	Sept. 11	2	1,000 ft. N.	12:32	4:20 pm.	.266*	.062 ppm
13	Sept. 11	2	1,000 ft. N.	5:20 pm.	10:20 pm.	.15	.070 ppm
12	Sept. 11	1	1,300 ft. N.	4:45 pm.	10:15 pm.	.165	.055 ppm
7	Sept. 12	1	2,000 ft. N.	6:40 am.	10:30 pm.	.115	.12 ppm
6	Sept. 12	4	2,600 ft. NE	10:55 am.	2:25 pm.	.1	Not Detected
8	Sept. 12	3	4,000 ft. NNE	10:00 am.	2:00 pm.	.12	.043 ppm
2	Sept. 13	6	1,870 ft. NE	9:15 am.	11:15 am.	.06	.036 ppm
3	Sept. 13	7	2,300 ft.NE/ENE	9:40 am.	11:30 pm.	.055	.015 ppm
4	Sept. 13	8	800 ft. ENE	9:50 am.	3:35 pm.	.17	.085 ppm
1	Sept. 13	5	800 ft. SE	11:20 am.	3:40 pm.	.13	.093 ppm
5	Sept. 13	9	800 ft. ESE	11:40 am.	4:45 pm.	.15	.023 ppm
22	Sept. 13	10		12:00 pm.	4:10 pm.	.125	.014 ppm

* 1 litre per minute.

10. DISCUSSION

The results of this survey demonstrate that the Ministry's guideline on 1/2-hour average VCM levels was occasionally exceeded during the sampling period in October/November 1974 near the Esso Chemical PVC plant in question. Because of the inclement weather conditions, which may have influenced the sample collection efficiency, and because of the short time period involved, however, these results should be considered as still preliminary in nature, pending the more thorough, long-term monitoring program recommended in this Report. Although the absolute significance of a few of those results is uncertain, they can be used with confidence for assessment purposes and as the basis of recommending an abatement program at the Esso plant. It is unlikely that any of the measured VCM concentrations are in error by more than 50% of the actual concentration at the sampling site at the time of collection. The error introduced in the analytical stage is certainly less than 30% and would tend to underestimate rather than overestimate the VCM concentrations as mentioned in Section 6.

The analytical methods appear to be reliable, but they should continue to be evaluated by the Air Quality Laboratory, especially with respect to the keeping properties of samples which may have to be stored for a considerable time before analysis because of transportation difficulties from the sampling site or backlog in the Laboratory.

APPENDIX I

Ontario

Ministry of the
Environment
5-5776

135 St. Clair Avenue West
Suite 100
Toronto Ontario
M4V 1P5

October 29, 1974

MEMORANDUM

TO:

FROM: P.C. Kuna, Criteria Development & Program Planning
Air Resources Branch

RE: Guidelines for allowable VINYL CHLORIDE concentrations in air

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At the present time the available information on the effects of vinyl chloride is too inadequate to allow the establishment of firm figures for ambient air quality criterion and design standard. In view of the pressing need for figures to be used immediately for approvals assessment and evaluation of current operations, the following guidelines are proposed:

On the basis of available medical evidence, the 24 hour ambient air quality objective is being set temporarily at 200 $\mu g/m^3$ (0.10 ppm approx.), while the guideline for individual sources is being proposed at 560 $\mu g/m^3$ (0.20 ppm approx.) at the point of impingement (1/2 hr. ave.).

It is estimated that sufficient data will be available in 6 months - 1 year to allow the establishment of a firm ambient air criterion and design standard. Present indications are that the final figures may well be lower than the above guidelines. Any Certificates of Approval issued on the basis of the guideline should be conditional, subject to re-assessment when the official design standard is established.

PCK:ia

P. C. Kuna

The data in Appendix II are:

WS_1 = wind speed at 33 feet above ground level in mph. X 10.

WD_1 = wind direction at 33 feet above ground level in degrees measured from true north (see Key)

WS_3 = wind speed at 300 feet above ground level in mph. X 10.

WD_3 = wind direction at 300 feet above ground level in degrees measured from true north (see Key)

All data were recorded at Station 14016, except where noted (*) which were recorded at the Sarnia Airport.

Key to Appendix II:

Compass Points	Code	Degrees	Compass Points	Code	Degrees
	00	Calm	SSW	20	195-204
	01	005-014		21	205-214
NNE	02	015-024	SW	22	215-224
	03	025-034		23	225-234
NE	04	035-044		24	235-244
	05	045-054	WSW	25	245-254
	06	055-064		26	255-264
ENE	07	065-074	W	27	265-274
	08	075-084		28	275-284
E	09	085-094	WNW	29	285-294
	10	095-104		30	295-304
ESE	11	105-114		31	305-314
	12	115-124	NW	32	315-324
	13	125-134		33	325-334
SE	14	135-144	NNW	34	335-344
	15	145-154		35	345-354
SSE	16	155-164	N	36	355-004
	17	165-174			
S	18	175-184			
	19	185-194			

APPENDIX II

OCTOBER 29TH, 1974

WS_1	WD_1	WS_3	WD_3	HR.
78	220	178	237	01
78	220	165	242	02
70	222	160	242	03
59	224	161	240	04
76	221	173	231	05
75	220	185	233	06
68	221	168	246	07
78	218	142	237	08
100	214	155	224	09
100	210	140	222	10
95	222	140	228	11
92	232	116	248	12
70	219	93	249	13
73	211	90	224	14
73	213	107	218	15
83	191	128	204	16
97	196	145	202	17
92	217	164	216	18
109	203	171	213	19
99	215	179	222	20
83	217	184	228	21
87	221	182	232	22
83	224	166	237	23
111	229	175	244	24

OCTOBER 30TH, 1974

WS_1	WD_1	WS_3	WD_3	HR.
114	216	172	228	01
114	220	173	230	02
93	230	162	246	03
126	223	177	240	04
119	220	177	231	05
113	224	166	235	06
93	231	135	250	07
89	242	123	267	08
98	258	134	274	09
118	263	138	270	10
107	257	125	268	11
119	260	123	275	12
134	268	154	276	13
134	272	161	280	14
130	257	144	270	15
119	248	144	262	16
132	235	157	254	17
126	238	172	260	18
119	234	160	259	19
118	236	174	263	20
109	229	171	262	21
90	239	163	276	22
103	261	157	281	23
86	267	157	290	24

OCTOBER 31ST, 1974

WS_1	WD_1	WS_3	WD_3	HR.
82	257	167	297	01
82	245	168	296	02
63	274	153	306	03
76	231	117]	294	04
81	224	102	271	05
81	225	108	269	06
78	225	110	274	07
79	220	99	267	08
93	229	120	258	09
132	259	138	273	10
107	259	118	270	11
114	265	131	274	12
138	248	130	256	13
146	232	144	247	14
146	253	150	262	15
113	236	120	256	16
89	223	122	242	17
94	225	139	238	18
91	221	166	237	19
106	232	214	254	21
111	232	191	261	22
136	247	200	265	23
155	253	207	268	24

NOVEMBER 1ST, 1974

WS_1	WD_1	WS_3	WD_3	HR.
138	246	197	269	01
153	259	212	272	02
133	255	199	273	03
105	243	170	271	04
107	237	174	265	05
103	247	158	267	06
117	243	172	269	07
107	250	165	277	08
103	266	166	289	09
124	284	153	293	10
126	318	144	315	11
129	328	127	324	12
145	2	149	344	13
125	347	128	330	14
149	321	156	316	15
124	336	127	324	16
97	320	121	314	17
49	294	113	315	18
36	247	96	315	19
43	229	96	321	20
26	88	62	356	21
23	130	85	567	22
16	52	56	112	23
18	65	57	120	24

NOVEMBER 2nd, 1974

WS_1	WD_1	WS_3	WD_3	HR.
35	68	73	110	01
33	73	71	120	02
38	93	78	144	03
51	84	81	127	04
55	90	93	79	05
74	82	111	85	06
76	92	100	95	07
73	90	93	94	08
79	92	88	101	09
74	109	74	120	10
52	123	51	132	11
54	128	49	140	12
48	138	43	144	13
58	170	48	161	14
45	172	43	171	15
86	18	36	360	16
43	185	60	183	17
40	180	59	187	18
72	201	73	194	19
85	216	70	210	20
80	216	86	219	21
104	212	104	213	22
88	219	101	219	23
102	215	106	220	24

NOVEMBER 3RD, 1974

WS_1	WD_1	WS_3	WD_3	HR.
101	215			01
103	213	117	215	02
98	212	110	218	03
81	219	130	217	04
102	213	104	222	05
		115	218	06
80	159			07 *
80	150			08 *
90	157			09 *
90	153			10 *
100	161			11 *
70	166			12 *
90	174			13 *
120	191			14 *
120	187			15 *
90	196			16 *
110	196			17 *
100	200			18 *
100	200			19 *
120	215			20 *
80	201			21 *
50	160			22 *
30	305			23 *
120	341			24 *

* Sarni
Airpor

NOVEMBER 4TH, 1974 (Sarnia Airport)

WS_1	WD_1	WS_3	WD_3	HR.
60	045			01
70	050			02
80	049			03
80	050			04
90	058			05
110	060			06
90	328			07
60	300			08
90	340			09
90	320			10
60	322			11
90	312			12
90	330			13
80	320			14
80	358			15
70	019			16
70	065			17
70	070			18
70	064			19
60	050			20
80	060			21
60	066			22
50	032			23
70	056			24

NOVEMBER 5TH, 1974 (Sarnia Airport)

WS_1	WD_1	WS_3	WD_3	HR.
90	325			01
90	310			02
100	305			03
80	310			04
150	295			05
150	299			06
80	050			07
120	055			08
110	045			09
130	042			10
110	046			11
120	040			12
70	040			13
90	038			14
110	030			15
100	029			16
60	015			17
100	006			18
100	355			19
120	352			20
110	345			21
100	340			22
100	328			23
80	325			24

NOVEMBER 6TH, 1974

WS_1	WD_1	WS_3	WD_3	HR.
				01
				02
				03
				04
				05
				06
				07
				08
				09
90	15	118	10	10
105	11	100	15	11
108	13	109	21	12
93	16	99	11	13
80	360	76	2	14
100	275	-	-	15 *
110	290	-	-	16 *
78	356	83	12	17
93	21	100	28	18
87	10	88	17	19
65	20	72	28	20
62	21	68	28	21
62	20	65	31	22
55	58	63	53	23
51	49	77	44	24

NOVEMBER 7TH, 1974

WS_1	WD_1	WS_3	WD_3	HR.
36	309	83	27	01
19	348	86	16	02
14	313	83	8	03
16	315	57	7	04
13	327	45	8	05
37	19	58	25	06
31	24	55	17	07
23	342	64	14	08
32	356	62	17	09
11	290	17	21	10
30	229	18	293	11
68	225	56	239	12
57	256	54	263	13
78	290	68	296	14
73	294	63	289	15
70	301	64	299	16
69	282	72	287	17
62	254	95	270	18
38	263	91	281	19
36	227	58	286	20
26	247	46	301	21
32	232	75	291	22
7	344	79	306	23
8	306	93	316	24

NOVEMBER 8TH, 1974

WS_1	WD_1	WS_3	WD_3	HR.
10	304	12.7	353	01
12	265	12.7	11	02
17	317	12.5	12	03
19	299	11.8	8	04
24	263	6.7	353	05
17	270	7.2	331	06
36	259	6.7	331	07
43	252	6.3	332	08
68	244	5.3	306	09
41	299	5.2	311	10
57	330	4.4	319	11
39	341	3.3	317	12
28	295	2.7	303	13
37	224	1.6	281	14
35	247	2.8	341	15
44	237	2.7	296	16
62	252	7.1	275	17
46	281	10.9	288	18
18	273	11.3	296	19
12	275	8.0	307	20
34	172	2.5	306	21
11	260	2.7	301	22
17	3	4.6	22	23
14	8	4.9	41	24